COMPOSITES UNITED

MARKET REPORT 2021

THE GLOBAL MARKET FOR CARBON FIBERS AND CARBON COMPOSITES

Market Developments, Trends, Forecasts and Challenges

– freely accessible short version –

SHORT VERSION

Michael Sauer & Denny Schüppel

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About Composites United e. V.

Composites United e. V. (CU) is one of the largest networks for fiber-based, multi-material lightweight design. Around 350 members have combined forces in this high-performance industry and research association to jointly develop lightweight engineering solutions of the future. Several regional clusters and specialist networks support the association`s activities in the DACH-region, as well as international representative offices in Japan, South Korea, China and India.

Composites United e. V. (CU) was created with effect from January 1 2019, from the two existing associations Carbon Composites e. V. and CFK Valley e. V. The headquarter is located in Berlin, but CU also has offices in Augsburg and Stade, as well as local representatives in numerous other locations. Further information on the activities of Composites United can be found at:

www.composites-united.com.

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Important Note: Published short report version

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1 General information

Now in its twelfth edition, the Composites Market Report – The global market for carbon fibers and carbon composites – has been published annually since 2010 as an overview of current market developments in the field of carbon fibers (CF) and carbon composites (CC). For this report, information and data were occasionally provided by CU-members or collected by the CU itself, as well as verified and supplemented with the help of external market data.

Composites United e. V. explicitly points out that due to the complex and dynamic market development with individually differing data sources, the information shown here can never provide a completely closed overview of the real market conditions. The aim of Composites United e. V. is to provide an overview of current trends and overarching development-directions based on the sources provided. All information is non-binding and without liability, so that no claims can be made against Composites United e. V. for the use of the data in the commercial sense.

Important note on current crisis situations with global impact

The exact extent and impact of the current crisis sitations on the global carbon fiber market are subject to a persistently volatile data basis at the current level. The very dynamic developments in combination with economic and political measures are difficult to predict in the short term, which influences the reliability of forecasts. This applies in particular with regard to the forecasts shown for specific areas. In this respect, it must be pointed out that the figures, diagrams and data shown can only represent a possible scenario of further developments. The exact manifestation of the underlying influencing variables must be further investigated in future studies. However, it

is of course a clear objective of the CU to achieve the most robust information possible on the basis of the given data. In this respect, attention must be paid to the possible limited comparability of specific statements in individual cases. We are at your disposal for an optimal evaluation and use of the data shown at market.report@composites-united.com .

In order to enable a better comparability with other market reports and to assure a higher plausibility of the shown information, the two most common growth rate factors and their calculations are summarised in the following:

Averaged Annual Growth Rate (AAGR) = Arithmetic Mean Return (AMR) = Arithmetic Average from n annual growth rates (AGR):

$$AAGR(t_1, t_n) = \frac{AGR(t_1) + AGR(t_2) + \cdots + AGR(t_n)}{n} = \frac{1}{n}\sum_{i=1}^{n} AGR(t_i)$$

Compound Annual Growth Rate (CAGR) = annual growth rate over n years assuming a proportionally constant growth:

$$CAGR(t_1, t_n) = \left(\frac{A(t_n)}{A(t_1)}\right)^{\frac{1}{n}} - 1 \quad \leftrightarrow \quad A(t_n) = A(t_1)(1 + CAGR)^n$$

2 The global carbon fiber market

2.1 Global carbon fiber demand

For the reporting year 2021, a global average carbon fiber demand of about 92.0 kt was determined. For an observation horizon since 2010, this corresponds to an average annual growth rate of +9.77% (CAGR 2010-2021). For a shorter development horizon over the past five years, the growth rate is +6.88% (CAGR 2017-2021). The decline observed for 2020 as a result of the global SARS-CoV-2 crisis situation was thus roughly in line with the expectations of the previous year's report. However, a subsequent upswing has now occurred much faster than previously projected. This results in a current average demand already above pre-crisis level (SARS-CoV-2). However, it must be explicitly pointed out that this is a snapshot of the given average demand situation. Any catch-up effects after the restoration of some supply chains and distribution channels, which were previously severely restricted by lockdown regulations, can hardly be filtered out from the actual market development. A resulting offset to the real market situation cannot be ruled out and is difficult to assess. In addition, it should be noted that the ongoing pandemic situation as well as other acute global crises can also lead to distortions in the demand volume in both directions at the present time. The calculation of the associated sales flows is currently biased by numerous measures taken by the companies as well as higher-level structures and political actors (e.g., aid programmes), so that a more detailed analysis and forecast can only be made retrospectively in the further course.

The prediction of further development is basically subject to the same challenging framework conditions. However, in the sense of an overarching assessment, two scenarios are further elaborated in relation to Figure 1 (page 10):

- **Scenario 1** is based on a demand estimate along currently available production quantities. This means that it is assumed in a simplified way that all the fibers requested can also be produced. In this respect, the expansion situation of the CF manufacturers' production capacity is indirectly reflected here. Expansion measures that are about to be completed are already taken into account. In the authors' view, this estimate is quite suitable for estimating an expected "lower production limit", even if not all requests can always be met in reality. Expansion measures in the CF market environment represent long-term and capital-intensive projects, so that it is only possible to react to real market demand with a noticeable delay, or this is even assumed in advance expectations. Therefore, uncertainties arise at this point, especially when interpreting a demand quantity forecast, which must be taken into account.
- **Scenario 2** is based on a continued market development with a constant annual growth rate (CAGR 2010-2021) compared to the base year (2021). Using the shorter observation horizon CAGR 2017-2021 results in a slightly lower development in the coloured area (cf. Figure 1).

Of course, there are numerous other possibilities for defining additional scenarios. Future short-term setbacks in market development are not predictable, but can lead to significant effects in the overall condensed CF market, as observed for the year 2020. At the same time, in the environment of the very innovative character of fiber composite technology, a technological leap or the market entry of an additional application is possible at any time, the volume of which can take up noticeable shares of the overall market in a short time. A correspondingly more aggressive growth scenario based on

such impulses is equally unpredictable, but it is certainly conceivable with regard to other material classes. In this respect, the two development forecasts shown are not necessarily to be understood as upper and lower limit lines, but represent two independent variants of numerous possible curve progressions.

Although the dynamic market structure depends on a multitude of complex factors, overarching market structures or individual main influencing factors can be interpreted. It is true that the CF industry also has a globally interlocked supply chain, which means that it is certainly affected by any transport difficulties, material bottlenecks, sanctions and trade conflicts. However, above all the positioning in the high-tech segment and thus a frequently pronounced unique feature in the application, including longer-term planning horizons, is to a certain extent stabilising for the industry. At the same time, the strong vertical integration and advanced horizontal diversification of CF manufacturers is highly advantageous here. Thus, the internal supply security, for example for PAN precursors, can be well represented. In addition, cushioning by other product areas is possible if individual applications are discontinued. Due to technical hurdles, it is not always possible to switch production capacities in line with current market demand at short notice or to make the necessary adjustments. The very concentrated market environment with a relatively small number of CF producers overall creates an exposed situation for impulses in both development directions and must be taken into account as a fundamental amplification effect. In summary, however, at the time of reporting, the overall picture is relatively stable compared to other material classes and industry segments, despite numerous current trouble spots.

The trend shown in Figure 1, especially with regard to future forecasts, is subject to a large number of influencing variables. The evaluation of production capacities by tonnage (see e.g. extended version of the Market Report 2021)

is currently much more robust in direct comparison to the breakdown of average demand shown here.

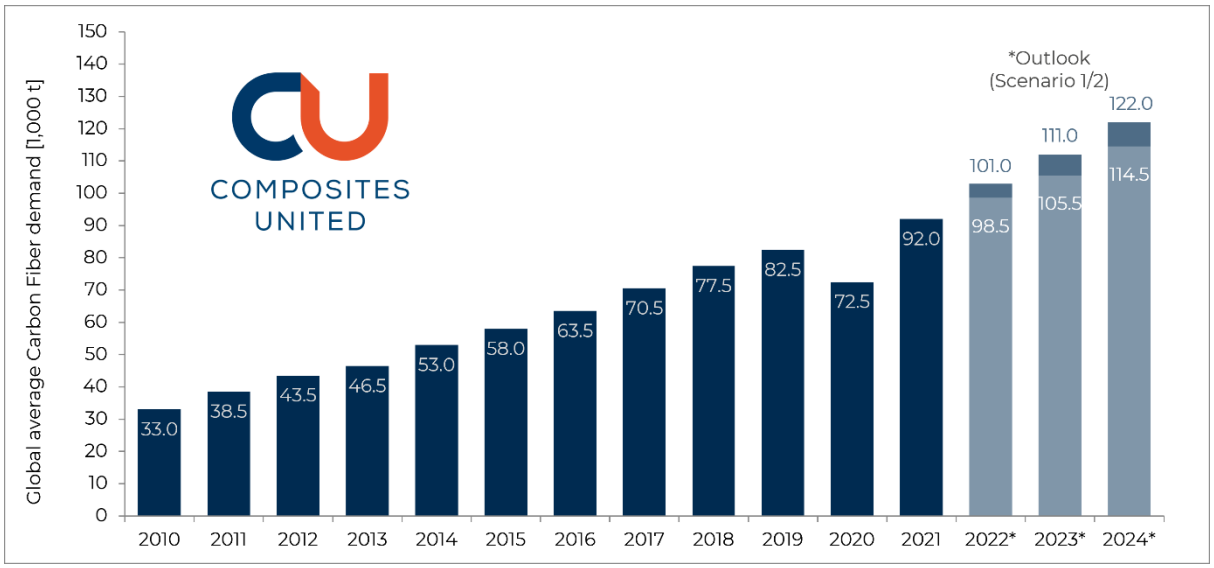

Figure 1: Development of the global average CF demand from 2010 to 2024 (*estimations; 03/2022).

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